

Iron Absorption in NGC 4258

Andy Young

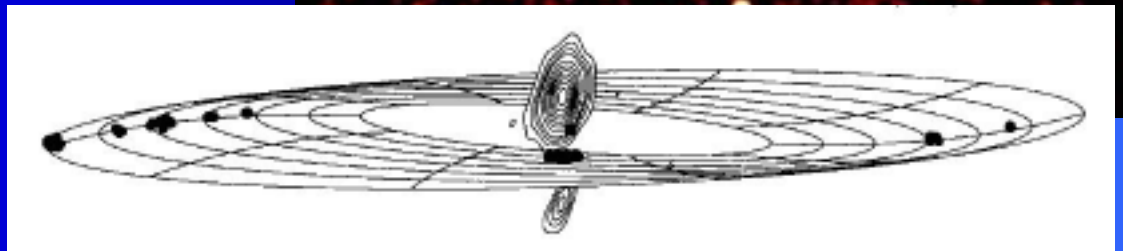
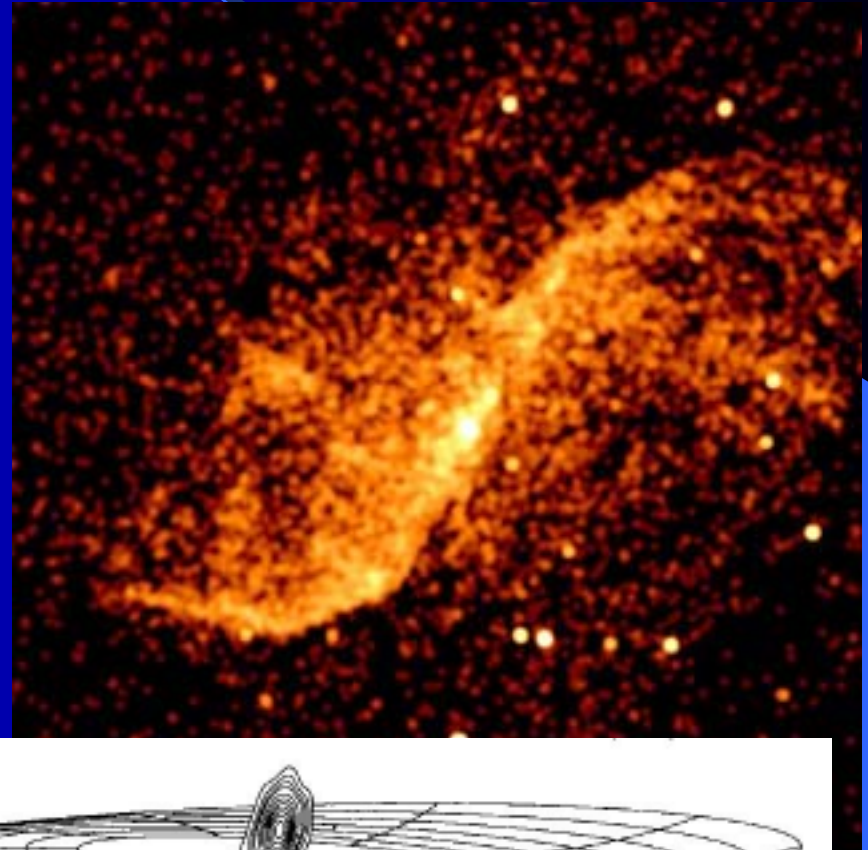
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NGC 4258

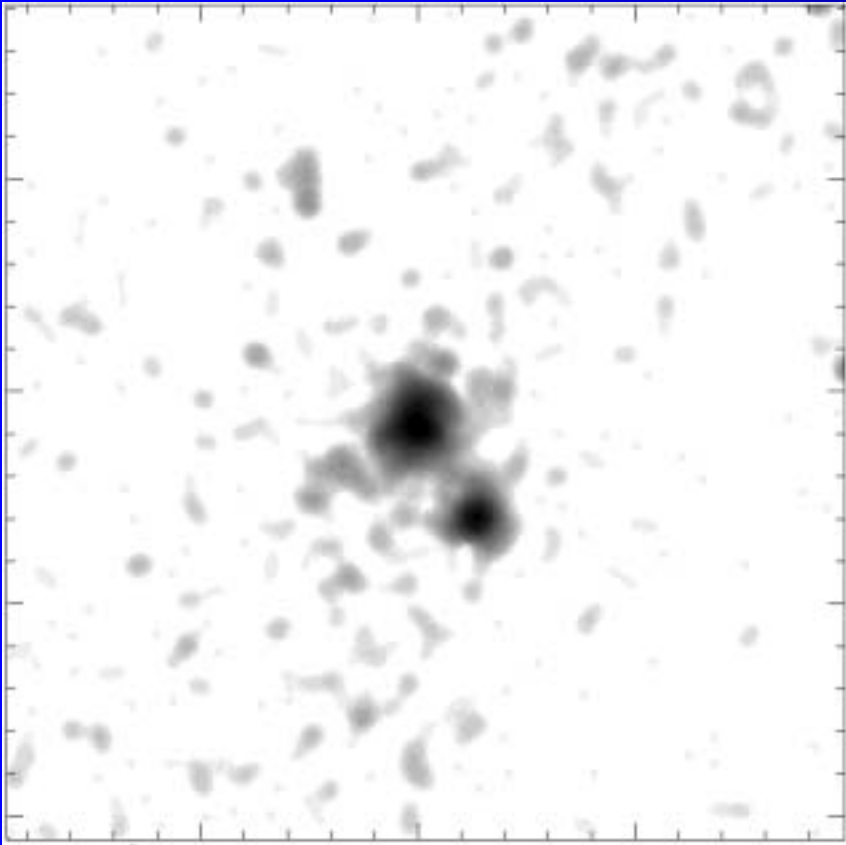
CXO : Wilson et al. (2001)

- Seyfert 1.9 galaxy
- H₂O masing disk
 - $M_{\text{BH}} = 4 \times 10^7 M_{\text{sun}}$
- Strong, polarized broad optical emission lines
- ASCA detected hard X-ray nucleus
 - Fe line variable
- Chandra
 - Anomalous arms



Masing disk and radio continuum : Greenhill et al. (1995)

Chandra ACIS Observation



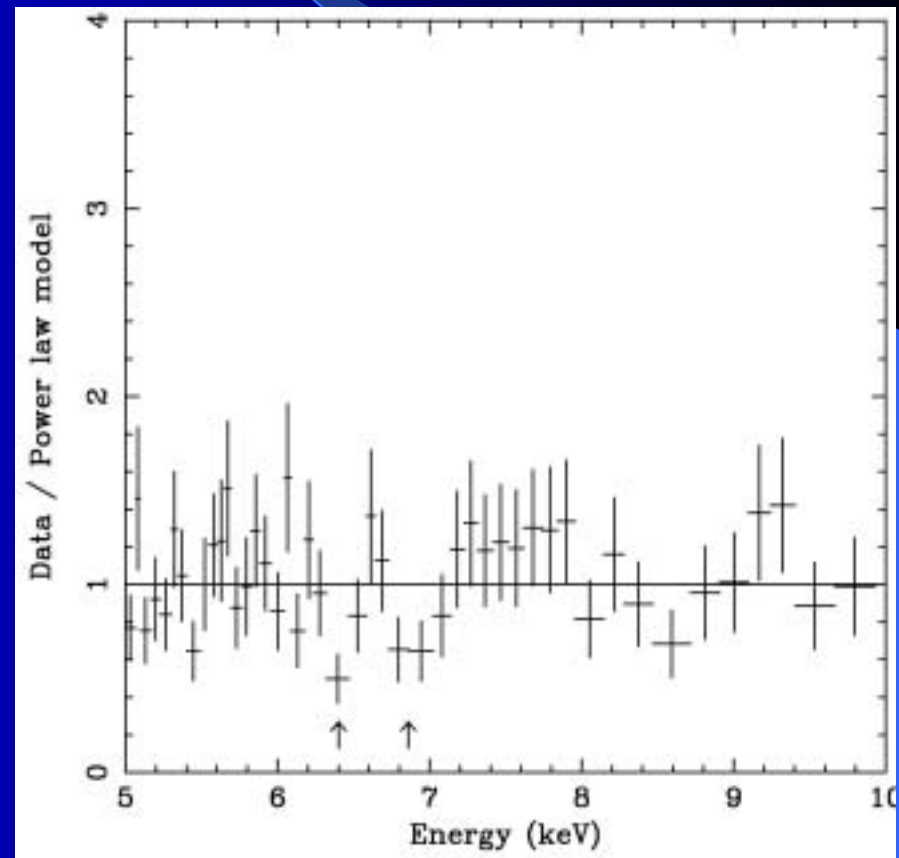
Young & Wilson (2003)

- Four ACIS-S observations
 - 1, 13, 20 and 7 ksec
- Some observations corrected for pile-up
- Nucleus (to NE)
 - Soft component
 - $N_H = N_H(\text{Gal}), kT = 1, L_x = 2 \times 10^{38}$
 - Hard component
 - $N_H = 7 \times 10^{22}, \text{Gamma} = 1.5, L_x = 10^{41}$
- Similar to ASCA

Iron Absorption Lines?

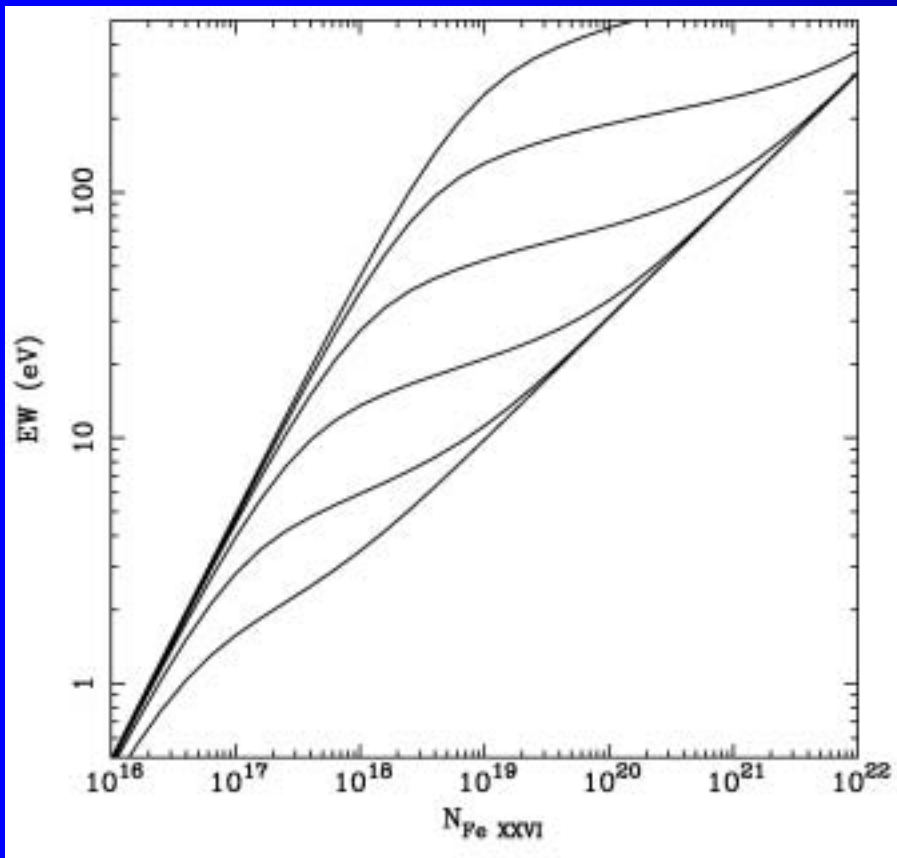
Ratio plot of Data / Model

- 14 ksec observation
 - Not during other obs.
- Absorption features at 6.4 keV and 7.0 keV
 - Unexpected
 - Each has an EW of ~ 200 eV (!)
 - Statistically significant with $> 99.5\%$ confidence
- Fe XVIII-XIX K alpha and Fe XXVI K alpha n=1-2 resonance lines
 - Two distinct zones



Young & Wilson (2003)

Curve of Growth

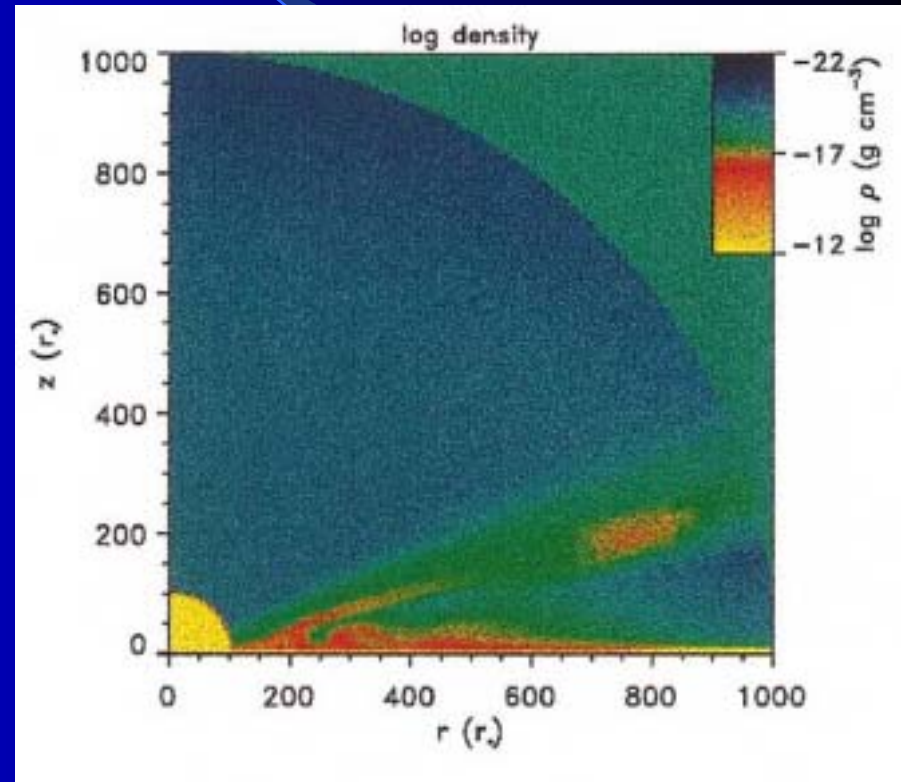


- $N_{\text{Fe XXVI}} = 5 \times 10^{18}$ to 6×10^{21} depending on kinematic temperature
- Linear part of curve of growth requires $kT \geq 10000$ keV or a velocity dispersion of 4000 km s^{-1}
- $N_{\text{H}} \geq 2 \times 10^{23}$
 - highly photo or collisionally ionized plasma has negligible soft X-ray opacity

$\log kT = 4, 3, 2, 1, 0, -1$ from top to bottom

Possible Interpretation

- Our line of sight grazes disk surface ($i=82^\circ$)
- Could be outflow from disk surface
 - Line-driven wind; even though $L \ll L_{\text{Edd}}$ this is a possibility
 - ADIOS
 - Mass ejection in ADAF \rightarrow jet transition
- Requires a detailed model
 - Confirm absorption is real before investing time!



Proga et al. (YEAR)

Absorption in Galactic Objects

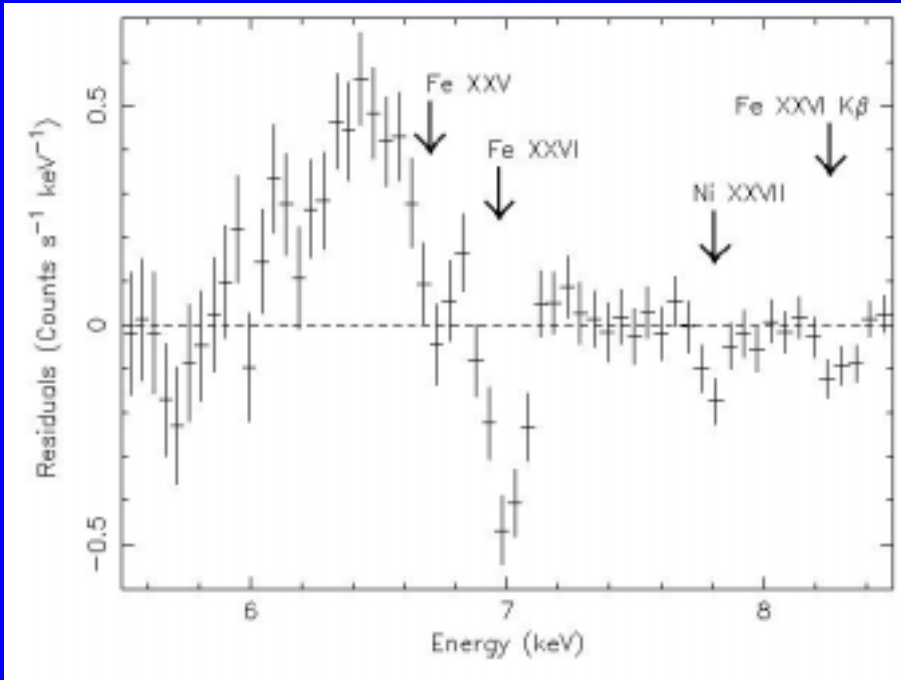
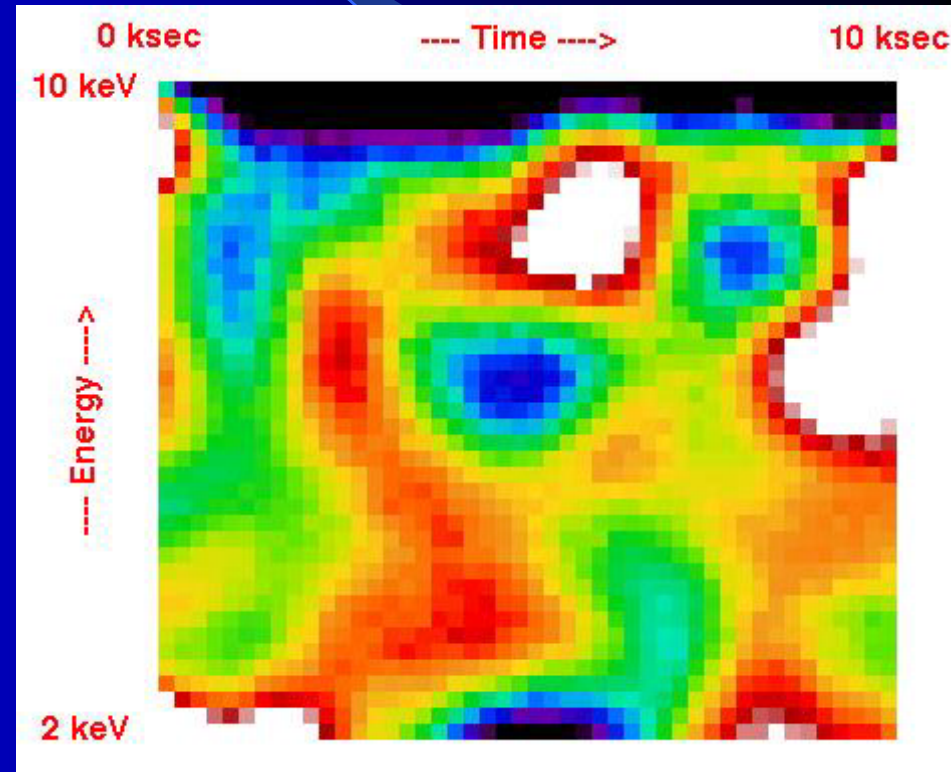


Figure caption and credit

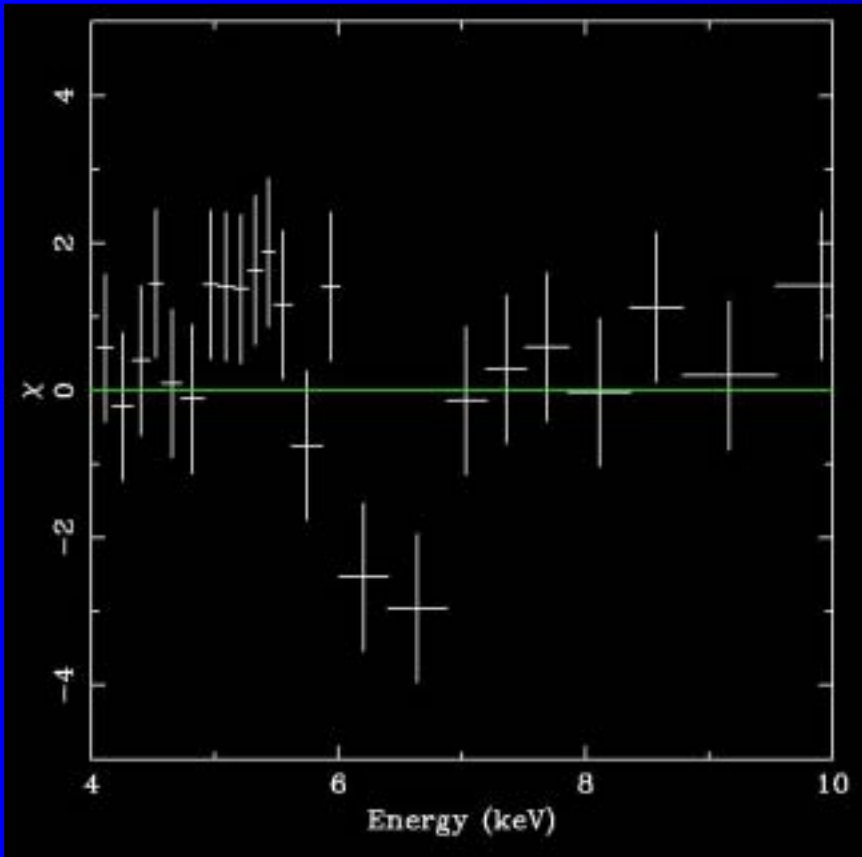
- Also show similar absorption features
 - GRO J1655-40; GRS 1915+105; GX 13+1; MXB 1659-298; X 1624-490; X 1254-690
 - High inclination systems
 - $\sim 20 - 150$ eV EW absorption features
 - One would expect variability timescale to be much shorter, so perhaps variability is averaged and higher S/N gives smaller EW measurements

XMM-Newton Observations

- Worried that $> \frac{1}{2}\%$ of 3σ results are wrong!
- 10 ksec XMM-Newton observation in archive
 - Haven't had a chance to look at them all yet
- Plot shows ratio of data to average spectrum
 - “dip” between 6.4 and 7 keV after ~ 5 ksec



Strong Absorption Feature



- Similar to feature observed with Chandra
- Well described by an absorption edge with $\tau = 1$